

Two New Species of the Genus *Philautus* (Anura: Rhacophoridae) from the Western Ghats, Southwestern India

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Abstract: Two new species of the bushfrog genus *Philautus* are described from the Western Ghats, southwestern India. *Philautus luteolus* is a medium-sized (ca. 27 mm SVL in males) yellowish frog with a few indistinct markings. From the most similar species *P. travancoricus*, *P. luteolus* can be distinguished by the lack of conspicuous black markings and by the rather pointed longer snout. Advertisement calls are long trills consisting of a short introductory phase with fast-repeated pulses and a long main phase with slowly repeated pulses. *Philautus tuberochumerus* is a tiny (ca. 18 mm SVL in males) dark brown frog and its humerus bone has a unique conspicuous tubercle projecting antero-ventrally. From the similar species *P. bombayensis*, it is easily distinguishable by its distinctly small size and absence of a papilla on the tongue. Advertisement calls are sharp, metallic sounds composed of short pulses which are repeated very slowly.

Key words: New species; *Philautus luteolus*; *Philautus tuberochumerus*; Rhacophoridae; Western Ghats, India

INTRODUCTION

Recently, a remarkable amphibian diversity has been discovered in Sri Lanka (Dutta and Manamendra-Arachchi, 1996; Pethiyagoda and Manamendra-Arachchi, 1998; Meegaskumbura et al., 2002). Especially abundant are rhacophorid treefrogs, and Pethiyagoda and Manamendra-Arachchi (1998) estimated that about 200 species remain to be described as new. This is largely due to the fact that little exploration has been done in the forest layers.

We think that the same is true for the anuran fauna of the Western Ghats, south-

western India. As Inger and Dutta (1986) stressed, Indian amphibian species and genera are most abundant in the Western Ghats of the West Peninsular region (Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala). In this region, a total of 17 genera and 99 species of anurans and four genera and 13 species of gymnophionans were listed by Inger and Dutta (1986), and Daniels (1992) listed 103 anuran and 14 gymnophionan species, most of them endemic to the Western Ghats. In the Western Ghats, new species have been described year after year (e.g. Das and Ravichandran, 1998; Vasudevan and Dutta, 2000; Bossuyt, 2002), suggesting that systematic and comprehensive herpetological surveys are still needed.

The majority of rhacophorid treefrogs in the

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Western Ghats are members of the bushfrog genus *Philautus*. Inger and Dutta (1986) listed 22 *Philautus* species in this region. Of these, Bossuyt and Dubois (2001) transferred four species to the genus *Micrixalus* and one to the genus *Rhacophorus*, put one species in the synonymy of an *Indirana* species and four species in the synonymy of other *Philautus* species, removed *P. leucorhinus* by restricting its range to Sri Lanka, and revived two names (*Philautus tinniens* and *Philautus wynaaden-sis*) created by Jerdon (1853). Finally, Bossuyt (2002) described *P. griet* from Mannar, Kerala. Thus, a total of 14 *Philautus* species are currently recognized as occurring in the Western Ghats.

We collected two *Philautus* species, all males, from several localities in the Western Ghats which did not fit any previous descriptions. These are named here as new species.

MATERIALS AND METHODS

Specimens were collected from Malleshwaram in Kudremukh, Chikmagalur district (13°12'N, 75°16'E), Madenadu near Medikeri, Kodagu district (12°27'N, 75°38'E), and Kirundadu near Madikeri (12°29'N, 75°47'E), all in the southern part of Karnataka state, during the breeding seasons from 1999 to 2003. Measurements were made on preserved specimens (type series and several specimens deposited in Rondano Bio-diversity Research Laboratory (RBRL), St. Aloysius College) using digital calipers under a head magnifying glass.

Abbreviations of the measured parts are: SVL (snout-vent length), HL (head length, from tip of snout to angle of jaws), HW (head width, at angle of jaws), SN (distance from tip of snout to nostril), IN (internarial distance), NE (distance from nostril to anterior corner of eye), ED (horizontal eye diameter), IO (inter-orbital distance, narrowest distance between upper eyelids), UL (width of upper eyelid), TYD (horizontal tympanum diameter), FHL (forearm and hand length, from elbow to tip of longest finger), HAL (hand length, from

base of outer palmar tubercle to tip of longest finger), FIL1–FIL4 (length of no. 1–4 finger, from junction of no. n and no. (n–1) finger to tip of no. n finger, FIL1 being measured from junction of no. 1 and no. 2 fingers), FD1–FD4 (disk width of no. 1–4 finger), HLL (hind limb length, from vent to tip of longest toe), FL (femur length, from vent to knee), TL (tibia length, from knee to ankle), TFL (tarsus and foot length, from ankle to tip of longest toe), FOL (foot length, from base of inner metatarsal tubercle to tip of longest toe), TOL1–TOL5 (length of no. 1–5 toe, measured similarly as in finger length), TD1–TD5 (disk width of no. 1–5 toe), IMT (length of inner metatarsal tubercle).

Because we found that one of the two new species had unique humerus bones, we made glycerin-cleared skeleton preparations from one specimen using the method of Klymkowsky and Hanken (1991). In this method bone is stained red by Alizarin Red S and cartilage is stained blue by Alcian Blue 8GX.

Philautus luteolus sp. nov.

Figs. 1 and 2., Table 1

Philautus species D: Kuramoto and Joshy, 2000.

Philautus cf. *travancoricus*: Kuramoto and Joshy, 2001.

Holotype

BNHS 4191 (Bombay Natural History Society), adult male collected by M. Kuramoto from Kirundadu, Kodagu, Karnataka, ca. 920 m in altitude on 16 August 2001.

Paratypes

BNHS 4192, adult male collected by S. H. Joshy from Kudremukh, Chikmagalur, Karnataka, ca. 940 m in altitude on 10 June 2003. OMNH Am 11412 (Osaka Museum of Natural History), adult male collected by M. Kuramoto from Kudremukh on 5 July 1999.

Diagnosis

Medium-sized *Philautus* (SVL ca. 27 mm in

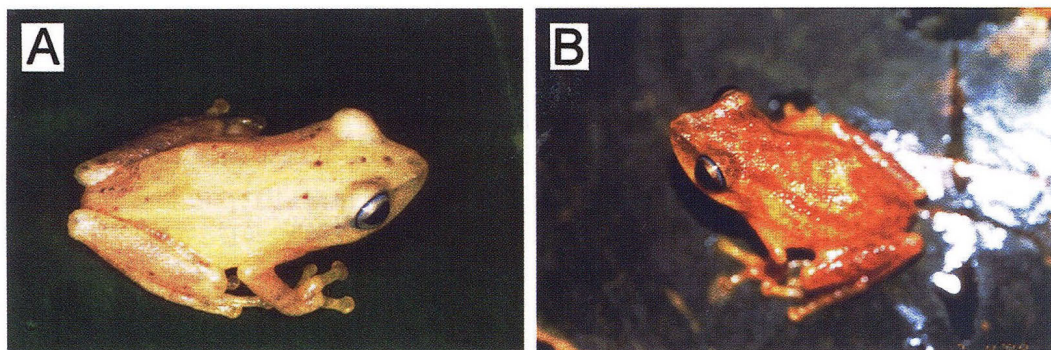


FIG. 1. *Philautus luteolus*. A: Holotype BNHS 4191 from Kirundadu. B: Darker color phase observed in a specimen from Kudremukh during the daytime (specimen number not specified).

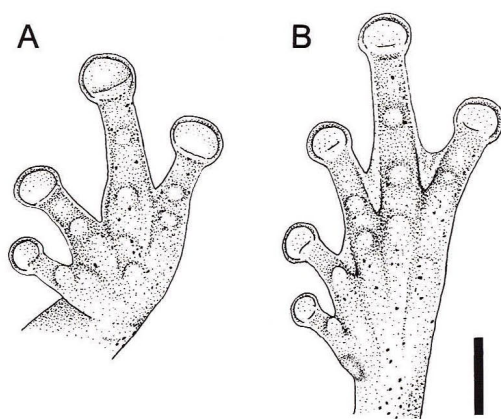


FIG. 2. Ventral view of left hand (A) and left foot (B) of *P. luteolus*. Scale 2 mm.

males) with yellow to yellowish brown dorsal coloration lacking distinct markings. This coloration readily distinguishes this species from other *Philautus* species in the Western Ghats. *Philautus luteolus* lacks black streaks on both sides of anterior dorsum or a few large black spots on dorsum and tibia which are present in the most similar species, *P. travancoricus*. The snout of *P. travancoricus* is round and its length is equal to eye diameter, whereas the snout of *P. luteolus* is rather pointed and longer than eye diameter. Advertisement calls are long trills with an initial short phase consisting of fast-repeated pulses followed by a long main phase consisting of slowly repeated pulses.

Description of the type series (three males)

Body moderately elongated. Head wider than long. Canthus rostralis distinct. Loreal region slightly concave. Snout slightly pointed, projecting beyond mouth. Nostril nearer to tip of snout than to eye. Eye diameter subequal to interorbital distance, the latter much larger than upper eyelid width. Tympanum small and indistinct. Supratympanic fold distinct. No papilla on tongue.

Hand longer than forearm. Finger length $3 > 4 \geq 2 > 1$ (means of the type series in mm: FIL1=2.21, FIL2=3.37, FIL3=4.84, FIL4=3.43; Table 1, Fig. 2). Finger disc large with distinct circummarginal groove (means of the type series in mm FD1=1.00, FD2=1.28, FD3=1.59, FD4=1.50). No web between fingers. Tibia subequal to femur. Toe length $4 > 3 > 5 > 2 > 1$ (means of the type series in mm: TOL1=2.01, TOL2=3.22, TOL3=4.23, TOL4=6.70, TOL5=4.16). Toe disc with circummarginal groove, slightly smaller than finger disc (means of the type series in mm: TD1=0.93, TD2=0.98, TD3=1.15, TD4=1.36, TD5=1.36). Toes 1/3 webbed (Fig. 2). Inner metatarsal tubercle small and indistinct. No tarsal fold. Heels touch or scarcely overlap when legs folded at right angle to the body, and reaches eye when stretched forward along body axis.

Dorsal surface and upper surface of limbs finely granulated without distinct ridges. Venter finely granulated. An external subgular vocal

TABLE 1. Measurements of male specimens of *Philautus luteolus* (in mm).

	Holotype	Paratype	Paratype	Type series plus two RBRL specimens (n=5)
	BNHS 4191	BNHS 4192	OMNH Am 1141	$\bar{x} \pm SD$ (Min–Max)
SVL	27.8	26.7	24.7	26.54 \pm 1.52 (24.7–28.1)
HL	7.7	7.5	7.5	7.48 \pm 0.20 (7.1–7.7)
HW	10.2	9.9	9.4	9.69 \pm 0.36 (9.3–10.1)
SN	2.0	2.1	1.9	1.91 \pm 0.15 (1.8–2.1)
IN	2.8	2.7	2.4	2.59 \pm 0.21 (2.3–2.8)
NE	3.7	2.4	2.4	2.84 \pm 0.57 (2.4–3.7)
ED	3.8	3.2	3.4	3.50 \pm 0.23 (3.2–3.8)
IO	3.4	2.8	3.3	3.35 \pm 0.40 (2.8–3.9)
UL	2.5	2.6	2.4	2.32 \pm 0.25 (2.0–2.6)
TYD	1.4	0.8	1.2	1.19 \pm 0.26 (0.8–1.4)
FHL	13.6	13.8	12.2	12.98 \pm 0.81 (12.1–13.8)
HAL	7.5	7.1	7.2	7.21 \pm 0.17 (7.1–7.5)
HLL	37.5	37.6	35.3	36.89 \pm 1.84 (34.8–39.3)
FL	13.2	13.0	12.6	12.66 \pm 0.79 (11.3–13.2)
TL	13.5	12.8	12.4	12.69 \pm 0.66 (11.7–13.5)
TFL	17.7	17.7	16.5	17.13 \pm 0.95 (15.8–18.0)
FOL	10.6	10.5	9.8	9.96 \pm 0.53 (9.3–10.6)
IMT	0.9	0.8	1.2	0.94 \pm 0.17 (0.8–1.2)

sac. No bony process on humerus bone.

Coloration

In life (Fig. 1), upper surface uniformly pale yellow or brownish yellow with a few small brown spots mostly along lines from snout to vent and from eye to vent. Leg with faint cross bars or a few brown spots. Iris pale gold encircled with black. Venter and vocal sac uniformly light yellow. Usually, color is pale yellow at night and becomes brownish in the daytime.

In preservative, dorsum and upper surface of limbs pale yellow to yellowish brown with slightly dark, irregular, longitudinal series of small indistinct patches. Indistinct dark bars on limbs. Indistinct dark line from tip of snout, through nostril and eye, to the base of arm. Lower surface whitish without any markings.

Advertisement calls

The advertisement calls (Kuramoto and Joshy, 2001) are long trills (often exceeding 1 min) with an initial short phase composed of fast-repeated pulses and a long main phase of slowly repeated pulses (3–4 pulses per sec). The dominant frequency is about 2.7 kHz. The males call from branches or leaves in secondary forest and bush by the roadside at night. Calling sites are usually more than 1.5 m above ground, and we could not find any water bodies around the collecting sites.

Etymology

From Latin *luteolus* meaning yellowish, indicating the body color of this frog.

Comments

This species fits the original description of *Philautus travancoricus* by Boulenger (1891; as *Ixalus travancoricus*) except that our spec-

imens lacked “larger black dots scattered on the back and on the tibia”, “a blackish streak on each side of the anterior half of the back”, and “a narrow band of pigment along the upper surface of the femur”. He also described the skin of *P. travancoricus* as “smooth”, which does not apply to the present species. Dorsal color was described as “cream”, apparently based on the preserved type specimen (a female from Bodanaikanur (=Bodinaikenur), Tamil Nadu; SVL 31 mm); color in life is unclear, but it may be yellowish. Except for this uncertain example, no other *Philautus* species in the Western Ghats has yellow or yellowish dorsal coloration.

The snout of *P. travancoricus* was reported to be round and its length equal to eye diameter. However, the snout of *P. luteolus* is rather pointed and much longer than eye diameter (Table 1). *Philautus luteolus* is smaller than *P. travancoricus* (SVL ca. 27 mm vs. 31 mm), but this difference may be attributable to sexual difference because *P. travancoricus* was described on the basis of a single female specimen.

Inger et al. (1984) noted a conspicuous color change in *P. femoralis* from Ponmudi, Kerala; it changes color from green to yellow. However, the dorsal color was reported to be invariably green when collected (undoubtedly at night). In *P. luteolus*, the dorsal color is yellowish day and night, and the yellowish color changes only slightly.

Philautus luteolus occurs in Kudremukh, Manenadu (ca. 1120 m in altitude) and Kirundadu but does not occur in coastal lowland around Mangalore (12°52'N, 74°51'E). We have not found any females.

Philautus tuberohumerus sp. nov.

Figs. 3 and 4, Table 2

Philautus species C; Kuramoto and Joshy, 2000.

Philautus cf. *bombayensis*: Kuramoto and Joshy, 2001.

Holotype

BNHS 4193, adult male collected by S. H. Joshy from Kudremukh, Chikumagalur, Karnataka, ca. 940 m in altitude on 15 June 2000.

Paratypes

BNHS 4194, adult male collected by M. Kuramoto from Kudremukh on 15 June 2000. OMNH Am 11413, adult male collected by M. Kuramoto from Kudremukh on 15 June 2000. OMNH Am 11414 (cleared skeleton), adult male collected by S. H. Joshy from Kudremukh on 15 June 2000.

Diagnosis

A small frog (SVL ca. 18 mm in males) with brown to dark brown dorsal color and conspicuous yellow spots on the anterior surface of the thigh. A bony projection on the underside of the humerus bone, which is unique to this species. From the most similar species *P. bombayensis* it is clearly distinguishable by its distinctly small size and absence of a papilla on the tongue. Advertisement calls are composed of a series of slowly repeated sharp pulses.

Description of the type series (three males)

Body rather robust. Head broader than long. Snout slightly pointed. Canthus rostralis rounded. Loreal region slightly concave or flat. Nostril nearer to tip of snout than to eye, and protruding beyond the line between tip of snout and anterior corner of eye when viewed from above. Interorbital distance much wider than upper eyelid. Tympanum small and indistinct, less than half eye diameter. Supratympanic fold distinct. No papilla on the tongue.

Hand longer than forearm. Small knob-like bony projection on the antero-ventral side of the humerus bone, as indicated in a cleared skeletal preparation (OMNH Am 11414: Fig. 3D). This projection is not obvious externally, but readily recognizable by stroking the lower side of the upper arm with thin forceps or a needle. Finger length $3 > 2 \geq 4 > 1$ (means of the type series in mm: FIL1=2.03, FIL2=2.34, FIL3=3.36, FIL4=2.10). Fingers with a

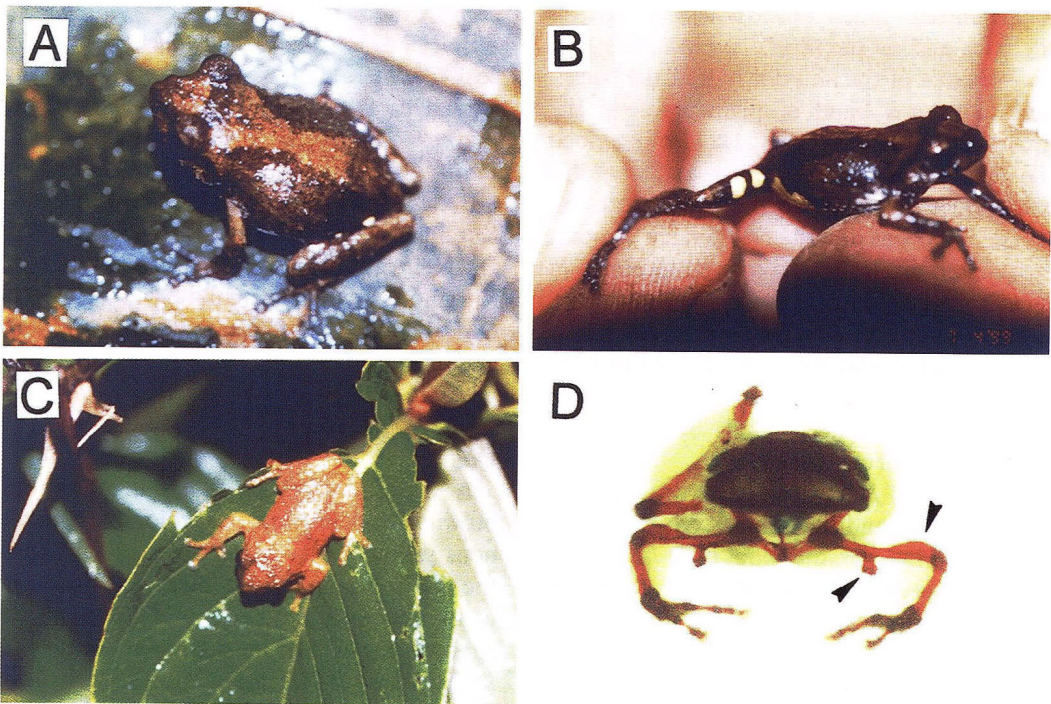


FIG. 3. *Philautus tuberothumerus*. A: Color phase during daytime. B: Showing yellow markings on thigh and groin. C: Color phase at night (A–C: Specimen numbers not specified). D: Anterior view of stained skeleton (OMNH Am 11414). Note the bony projection on the antero-ventral side of the humerus and the thick ends of the humerus (arrows).

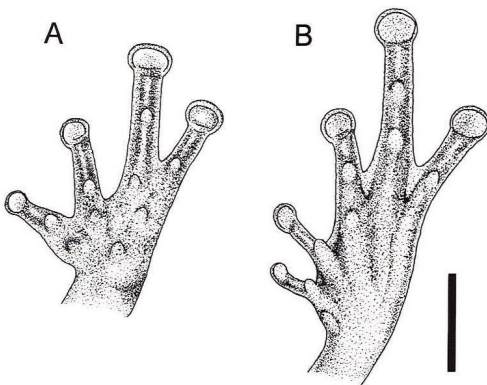


FIG. 4. Ventral view of left hand (A) and left foot (B) of *P. tuberothumerus*. Scale 2 mm.

large disc which has a distinct circummarginal groove (means of the type series in mm: FD1=0.51, FD2=0.66, FD3=0.96, FD4=0.90). No web between fingers. Subarticular

and palmar tubercles well developed (Fig. 4). Femur slightly longer than tibia. Toe length $4 > 3 \geq 5 > 2 > 1$ (means of the type series in mm: TOL1=1.44, TOL2=2.07, TOL3=2.92, TOL4=4.10, TOL5=2.89). Toe discs large, with a circummarginal groove (means of the type series in mm: TD1=0.54, TD2=0.66, TD3=0.76, TD4=0.88, TD5=0.74). Rudimentary web between toes (Fig. 4). Inner metatarsal tubercle moderate. No outer metatarsal tubercle. No tarsal fold. Heels overlap slightly when the legs are folded at right angles to the body, and reach the posterior corner of the eye when stretched forward along the body axis.

Dorsal surface rather coarsely granulated. A pair of wide ridges from the posterior corner of the eye, obliquely running toward the body axis, and extending parallel to the level of the arm base. Lower surface finely granulated. An

TABLE 2. Measurements of male specimens of *Philautus tuberothumerus* (in mm).

	Holotype	Paratype	Paratype	Type series plus five RBRL specimens (n=8)
	BNHS 4193	BNHS 4194	OMNH Am 11413	$\bar{x} \pm SD$ (Min–Max)
SVL	18.2	17.4	17.9	17.84 \pm 0.56(17.3–19.0)
HL	4.5	5.5	5.2	4.85 \pm 0.36 (4.4–5.5)
HW	6.6	6.7	6.9	6.33 \pm 0.44 (5.5–6.9)
SN	1.1	1.2	1.6	1.24 \pm 0.15 (1.1–1.5)
IN	1.8	1.9	2.3	1.70 \pm 0.33 (1.4–2.3)
NE	1.4	1.0	1.6	1.48 \pm 0.23 (1.0–1.7)
ED	2.3	2.3	2.3	2.31 \pm 0.14 (2.1–2.3)
IO	2.4	2.4	2.6	2.46 \pm 0.24 (2.0–2.7)
UL	1.7	1.7	1.6	1.73 \pm 0.13 (1.5–1.9)
TYD	1.0	0.8	1.0	0.86 \pm 0.11 (0.7–1.0)
FHL	8.5	8.0	9.3	8.36 \pm 0.61 (7.5–9.3)
HAL	4.5	5.3	5.0	4.91 \pm 0.36 (4.5–5.6)
HLL	24.0	22.5	25.1	23.69 \pm 1.31 (21.7–25.2)
FL	9.3	8.2	9.0	8.44 \pm 0.64 (7.7–9.3)
TL	9.0	8.0	8.9	8.21 \pm 0.64 (7.2–9.0)
TFL	11.6	10.6	12.3	11.20 \pm 0.61 (10.6–12.3)
FOL	7.1	6.7	7.5	6.94 \pm 0.38 (6.3–7.5)
IMT	0.8	1.0	1.0	0.88 \pm 0.15 (0.6–1.0)

external subgular vocal sac.

Coloration

In life (Fig. 3), brown to dark brown, sometimes with pale or dark hourglass pattern or hourglass-like stripe from eyes to vent. Dark bar between eyes often present. Large yellow or reddish yellow markings near groin (Fig. 3B), which fade to white in preserved specimens.

In preservative, upper surface dark brown, leg with a few darker bands. Throat mottled with dark brown. Venter with numerous, large or small, whitish markings on dark brown. Undersurface of thigh and posterior surface of arm with small whitish spots. Large whitish markings on the posterior part of flank and anterior side of femur.

Color changes to some extent; during the daytime dorsal color becomes darker and dorsal markings such as the hourglass pattern

and interorbital stripe tend to become more conspicuous than at night (Fig. 3A–C).

Advertisement calls

The advertisement calls (Kuramoto and Joshy, 2001) are a series of slowly repeated (1–2 sec interval) short pulses with a dominant frequency of about 4 kHz. Males call from among lower vegetation, often less than 50 cm above ground. Around the collecting sites, we could not find water bodies suitable for the life of aquatic larvae, suggesting direct development of this species as observed in *P. variabilis* (Patil and Kanamadi, 1997).

Etymology

Latin meaning “knobbed humerus”, the unique characteristic of this frog.

Comments

This species fits the original description of

P. bombayensis from Castle Rock, Karnataka (Annandale, 1919; as *Ixalus bombayensis*) fairly well. However, *P. bombayensis* was reported to be 30 mm in SVL and to have a papilla on its tongue (Annandale, 1919; Ahl, 1931). In the present species the male frogs are much smaller than the value given for *P. bombayensis* (including males) and the tongue lacks a papilla.

The very sharp and loud calls of this species resemble the calls of *P. variabilis* described by Daniels (1998). He expressed the call of *P. variabilis* as a loud metallic “tink; tink-tink”. Although this description of the call agrees with the call of the present species, the smaller body size and rudimentary webbing clearly discriminate this species from *P. variabilis*. Recent acoustic analyses (Kanamadi et al., 2001) revealed that the advertisement calls of *P. variabilis* begin with a few single note calls followed by multiple (2–19) note calls. Such a remarkable change in call types was not observed in *P. tuberochumerus*. *Philautus variabilis* from Ponmudi, Kerala is much larger than *P. tuberochumerus*, SVL being reported as 27 and 28.5 mm in males (Inger et al., 1984).

The peculiar projection on the upper arm is bony as revealed by skeletal preparations (Fig. 3D). Both ends of the humerus are very thick. We noticed that the arms were folded under the chest when the frog was anesthetized, so tightly folded that it was hard to extend them. Whether these characters are male-specific or not is unknown because no female specimens were obtained. Among the many specimens of *P. bombayensis* deposited in BNHS, there are small ones which resemble *P. tuberochumerus* in size. However, these do not have a bony knob on the underside of the humerus so far as determined by stroking. We could not examine whether these were males or juveniles. Günther (1858) examined osteological characters (apparently based on skeletal preparations) in the original description of *P. variabilis* (as *Ixalus variabilis* from Sri Lanka), but did not mention any peculiar bony process on the humerus, a conspicuous char-

acter that could not be overlooked.

We observed this species in Kudremukh and Kirundadu, but did not find it in coastal lowland around Mangalore. We have not found any females.

DISCUSSION

Frost (2002) listed a total of 85 species in the genus *Philautus*. From geographic distribution, these can be divided into three groups. The first group consists of 31 species in the Philippines, Borneo, Java, Sumatra, and Malaya; the second consists of 26 species in the mountainous regions of Vietnam, Thailand, Myanmar, China, northeast India, Bhutan, and Nepal; and the third consists of 28 species in south India and Sri Lanka. Apparently these three groups have long been isolated from each other, and it is probable that many species have diverged within each region. In India, northeastern and southern distribution ranges are widely separated. Although there should be a phylogenetic relationship between the two Indian groups, many species of the Western Ghats may have diverged within this mountain range.

Phylogenetic relationships between species of the genus *Philautus* are poorly known. Bossuyt and Dubois (2001) placed two Bornean species in the subgenus *Gorhixalus* and seven Sri Lankan species in the subgenus *Kirtixalus*, thus implying close species relationships within the subgenera, but the relationships among the remaining species (subgenus *Philautus*) are obscure. Some authors (e. g. Emerson et al., 2000; Marmayou et al., 2000) used a few *Philautus* species from southeast Asia to construct a phylogenetic tree by DNA sequencing, but their results provided no information about species relationships within the genus *Philautus* as a whole. Meegaskumbura et al. (2002) constructed a tree from mitochondrial DNA sequencing data, in which three Indian, three southeast Asian, and many (mostly undescribed) Sri Lankan *Philautus* species were involved. From this tree, it became apparent that southeast Asian species (from

Borneo and Java) constitute a separate cluster from that of Sri Lankan and Indian species. Of the three Indian species (from the Western Ghats), *P. charius* and *P. signatus* form a cluster of their own, whereas *P. wynaadensis* form another cluster together with Sri Lankan species. More extensive comparisons are needed to elucidate species relationships in the genus *Philautus*.

Species identification and discrimination are difficult in the genus *Philautus* (Inger and Stuebing, 1997, p. 163). Many morphological features are common to many species and morphometric features are rather trivial for these small frogs. Inger et al. (1984) ascribed the discrepancy between their materials and the original descriptions to geographic variation. In fact, variations seem extensive regarding size, ratio of body parts, coloration, and so on. Several species of south India were originally described on the basis of frogs obtained from Sri Lanka (e. g., *P. femoralis*, *P. temporalis*, and *P. variabilis*), but no detailed comparisons between Indian and Sri Lankan populations have been made. Under these circumstances, it is necessary to accumulate precise data especially on live specimens such as coloration and acoustic features.

Many frog species in the Western Ghats show considerable color changes as exemplified by the work of Inger et al. (1984). We observed that *P. wynaadensis* changes dorsal color from reddish brown (at night) to pale gray or brownish gray (in the daytime). Although color changes are very common in many rhacophorid species, we noticed some remarkable color changes in other frogs. For example, a characteristic symmetric dark pattern on the back of *Microhyla ornata* from the Western Ghats disappears at night; instead, it becomes uniform dark red without showing any traces of symmetric pattern. For identification in the field, it is necessary to record the range of individual color variation.

Also important is to characterize a species by its acoustic features. To date, call structures of only four *Philautus* species are available in the Western Ghats (Patil et al., 1996; Kana-

madi et al., 2001; Kuramoto and Joshy, 2001). Detailed examination of the call repertoires, advertisement, territorial, and warning calls, are needed. We expect that the combined set of these morphological and acoustic data from live specimens, together with morphometric data from preserved specimens and DNA sequencing, will aid in clarifying the rather confusing taxonomic status of the genus *Philautus*.

Krishnamurthy and Hussain (2000) listed four *Philautus* species (*P. charius*, *P. femoralis*, *P. glandulosus*, and *P. leucorhinus*) in Kudremukh, of which we found only *P. leucorhinus* (the populations should now be referred to as *P. wynaadensis*). We could not record calls of *P. femoralis* and *P. glandulosus* in Kudremukh. It is probable that some species confined themselves to particular kinds of habitat, thus segregate themselves from each other in microhabitat, as in Bornean species (Inger and Stuebing, 1997, p. 163).

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